ORDA Redundancy

This paper presents the changes from and differences between legacy redundant configurations and ORDA redundant configurations. Several legacy components for redundancy are specific to the legacy Concurrent design, and are not applicable to the ORDA solution. As a result, these components were removed from the ORDA design. Other changes were made to simplify redundant control and communication.

The ORDA redundant design goals are to:

- reproduce legacy hardware functionality
- provide better control between the 2 channels
- simplify the design without losing any functionality.

In regards to hardware, these goals translate into improving system reliability and maintainability by using the minimum hardware needed for the functionality. In regards to software, these goals translate into making both channels work the same as much as possible and simplifying channel switching without sacrificing safety or security.

The three main differences between legacy/ORDA are:

- Communications –X.25 and VME replaced with TCP/IP
- Power – the Full Power-Off Relay Assembly in NWS Redundant is driven by DC voltage; this is unavailable to ORDA. The power manager in the ORDA design performs this functionality.
- Control –RS232 for interprocessor communications is replaced by TCP/IP interprocessor communications. In addition, the ORDA design has simplified some of the control functions, explained later in this report.

In the next section of this report, the specific changes from the legacy design to the ORDA design are discussed in more detail and the benefits are described.

1. TCP/IP Communications

a. Wideband communications in the Legacy design uses a VME chassis and the X.25 protocol. The VME chassis is expensive, not highly reliable, and not as widely available as Ethernet. The X.25 protocols were developed for and primarily used for voice communication, where sequence timing is vital. TCP/IP is better suited to data transmission and simplifies design to allow multiple data streams on the same communication channel. A router with a CSU card allows better security and consolidates wideband communication hardware.

b. TCP/IP uses modern data communication protocols and reduces communication hardware needed. It also improves reliability and security.

2. Removal of Wideband Switch from NWS Redundant

a. The change to TCP/IP facilitated the removal of the Wideband Switch and allows use of a single router (located in Channel 2 as the Wideband Switch was). In the ORDA design, each channel has its own IP address to avoid communication confusion.

b. This design reduces hardware in the communication chain and standardizes communication for all configurations.

3. Removal of A/B Switch and STATMUX from NWS Redundant

a. Each channel's RDA HCI is routed to the MSCF equipment, eliminating the need for the current Remote MMI display at the Forecast Office. For out of bandwidth administration, the ORDA design will have a Secure Remote Access Server dial-in capability.

b. Removal of the A/B switch and the STATMUX reduces configuration specific hardware and standardizes communication for all configurations.

4. Removal of relay box from NWS Redundant

a. The legacy system controls the Full Power-Off Relay Assembly for the channel critical contactor through a DC voltage supplied by the Swing Out Power Supply (SOPS). Because the SOPS is being removed and we do not have any equivalent DC voltage to drive this relay assembly, we had to replace its functionality. The ORDA's APC Power Manager directly controls the critical contactor (the critical contactor is switched by AC), thereby simplifying the design. The APC Power Manager also directly controls the cabinet blower fans. This design duplicates the legacy design's ability to shut down the channel remotely.

b. The removal of the Full Power-Off Relay Assembly eliminates hardware specific to this configuration, standardizes power control, and provides more detailed remote power management of the entire channel.

5. Making both RDA HCIs available at the MSCF equipment in FAA configuration.

a. Legacy FAA systems cannot access the MMI remotely (except through the RMS). This change to the system ties the 2 RDA LANs together so the RDA HCI for each channel can always get to the MSCF equipment. This means a technician at the WFO can always access either RDA HCI for maintenance.

b. This expands the technician's capabilities to use the RDA HCI for maintenance.

6. Remote access to terminal from RMS for FAA

a. The legacy RDA has an RMS connection to the System Console port. This allows FAA technicians to remotely perform all RDASOT diagnostics, as well as giving out-of-bandwidth power control for remote power cycling. Since ORDA has no direct analogue to the legacy CDS (Concurrent Diagnostic System), we are providing multiple ways of accessing the system. First, RMS has a serial link to a Baytech power controller (the same model RPG has) so an FAA technician can remotely cycle power to any processor. Next, there is a serial link to the RCW (Radar Control Workstation) so an FAA technician can remotely use the RDA HCI for maintenance, or open a terminal for OS level work.

7. Control logic to allow NONC from Channel 1

a. Legacy design did not allow a NONC command to be issued from Channel 1 since only Channel 2 software can command the DAU to physically switch the channels. In the ORDA design, channel 1 will be allowed to issue a NONC command. The ORDA software on Channel 1 will request that Channel 2 perform the switching. If possible, Channel 2 will command the DAU to switch channels and will report status back to Channel 1 software.

b. The ORDA implementation will make channel switching symmetric for each channel

8. CONC not issued from L/R (Either) state

a. Legacy design allows a CONC issued locally from the Either state. ORDA will not allow any commands from the Either state for security reasons. All commands must be from an authorized system state (RPG, HCI, or RMS). A CONC command from an RDA HCI when the system is in Either state will execute the following sequence

   i. Switch the system state to LOCAL (RDA HCI)
   ii. Execute the CONC command

b. This implementation provides improved security and verification that all commands were issued by an authorized user.

9. Expansion of ability of NONC issued from RDA HCI to switch channels

a. In legacy, a NONC issued from local control will only work if the other channel is in certain states (the conditions for when the system is in RPG (Remote) control are not changing). ORDA will expand the NONC command to allow it to switch channel control whenever communication is available between channels and the other channel is in Either or the same control state (i.e. if NONC is issued from RDA HCI, the other channel will

only accept NONC if it's in Either or RDA HCI. The same for RMS, a NONC will only switch control if the other channel is in Either or RMS. Table 1 shows the logic.

b. Since a NONC can be issued from both channels now, it makes sense to allow easier switching both ways without compromising safety or security.

	Channel 2 Control			
CONC issued from:	Either	RDA HCI	RMS	RPG
CH1 RDA HCI	Channel 1	Reject	Reject	Reject
CH1 RMS	Channel 1	Reject	Reject	Reject
CH1 RPG	Channel 1	Reject	Reject	Channel 1
NONC issued from:				
CH1 RDA HCI	Channel 2	Channel 2	Reject	Reject
CH1 RMS	Channel 2	Reject	Channel 2	Reject
CH1 RPG	Channel 2	Reject	Reject	Channel 2

Table 1: Channel Control

NOTES: for Channel 2 commands, just reverse references between CH1 and CH2. Channel 1 and Channel 2 react the same to all commands. A valid CONC is only issued from a non-controlling channel and a valid NONC is only issued from a controlling channel. No commands are ever issued in Either (we switch control before executing the command).

10. Local Enable at RPG during Operate will change state to Either

a. Currently when the RPG selects Local Enable, there is no feedback on the MSCF or the MMI to let the operator know the state has changed, and the MMI can take control. Switching the state to Either during Operate when the RPG gives a Local Enable command will show that control is available and can be taken from the RPG. RMS can take control from this state, also, unlike in legacy.

b. The operator will always know if someone else can take control, and this allows RMS to take control easier.

Other Redundancy changes considered:

Failover when communications lost
Automatic switching for Inoperable conditions
SIGMET Redundancy utility

The ORDA design will standardize redundant operations across both channels, simplify operations and reduce technician training. The hardware changes will increase reliability and simplify logistics. No special hardware, other than cabling and the Baytech power manager for FAA, is required for redundant configurations. The ORDA design will allow easier modifications and improvements in the future.